Collider-Accelerator Department

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managed by Brookhaven Science Associates
for the U.S. Department of Energy

August 29, 2003

Mr. Frank C. Kornegay
ES&H Manager
SNS Department
Oak Ridge National Laboratory
701 Scarboro Road
Oak Ridge, TN 37830

Dear Mr. Kornegay:

As a follow-up to our August 27 recommendation to authorize permission for DTL1 commissioning to commence, the Accelerator Readiness Review Team encloses its report on the ARR for Drift Tube Linac Tank 1 (DTL1) Commissioning. The signature page in the report will be completed as soon as practicable, and it will be sent at a later time.

During this ARR visit, the Team observed a more mature operations organization. We noted fewer findings relative to the previous ARR visit, and we feel the issues noted were characteristic to this stage of SNS development. We continue to be impressed by management's attention to significant events, and we look forward to the next visit.

Very truly yours,

Edward T. Lessard

Edward T. Lessard
Associate Chair for ES&H/Q.A.

Enclosure

Electronic Copy to:

G. Dodson (SNS)
A. Etkin (BNL)
D. Fitzgerald (LANL)
N. Holtkamp (SNS)
S. Kennedy (ORNL)
R. Mau (FNAL)
T. Mason (SNS)
L. Price (DOE at SNS)
L. Radcliff (DOE at SNS)
W. Ruzicka (ANL)
C. Schaefer (BNL)
M. Vance (ORNL)
D. Werbeck (LANL)

Spallation Neutron Source

Accelerator Readiness Review
Drift Tube Linac Tank 1 Commissioning

August 12 through 14, 2003

Signature Page

On August 8, 2003, the Spallation Neutron Source (SNS) Accelerator Systems Division Director declared the Drift Tube Linac Tank 1 (DTL1) ready to commission (see Appendix 1). Following this declaration, a team consisting of the personnel listed below was charged by the ES&H Manager of the SNS Project to perform an Accelerator Readiness Review of DTL1 from August 12 to 14, 2003. This independent review team was charged with evaluating documentation, procedures, training records, operating plan and hardware readiness.

This review was conducted in compliance with the provisions of DOE Order 420.2A, *Safety of Accelerator Facilities.*

Team member signatures below denote concurrence with conclusions and recommendations identified in this report.

Edward Lessard (BNL) Edward T Lessard

Asher Etkin (BNL)

Sandra Kennedy (ORNL) Sandra Kennedy

Robert Mau (FNAL)

William Ruzicka (ANL) William G. Ruzicka

Charles Schaefer (BNL)

Richard Werbeck (LANL) R D Werbeck

Table of Contents

Appendices

Executive Summary

The Accelerator Readiness Review Team was appointed by the SNS ES&H Manager on September 9, 2002 and participated in the second phase of a modular commissioning strategy from August 12 to 14, 2003. The commissioning of parts of the facility is occurring at the same time other parts are being installed. The ARR Team performed an Accelerator Readiness Review (ARR) of the Drift Tube Linac Tank 1 and evaluated relevant documentation, procedures, training records, operating plan and hardware readiness.

A *Plan of Action* describing the ARR approach for the review is attached as Appendix 2 and was prepared in compliance with the Implementation Guide for DOE Order 420.2A, Safety of Accelerator Facilities.

Prior to the site visit, the ARR process was supported by documentation made available with the internet and by a video conference. On August 12, an opening presentation was made by SNS staff and management (see Appendix 3) and was followed by a tour of the facility. Presentations continued the next morning and interviews with subject matter experts occurred throughout the remainder of the visit. Document reviews and facility inspections also occurred during the visit. Appendix 4 provides a series of summary reports outlining the results of these interviews and facility visits.

It is the consensus of the ARR Team that the SNS Project management has conducted a comprehensive review and all provisions of the SAD necessary for DTL1 commissioning were addressed. Adequate controls and policies are in place to extract beam from the source and transport beam safely to the DTL1 beam stop. A few procedures and actions were not completed at the time of the on-site review but were in place on August 26, 2003. These were identified as pre-start findings in this report. The ORNL representative on the Team monitored progress in completing these items and the Team recommended approval for commissioning shortly after the pre-start findings were closed.

Introduction

Background

The linac portion of the accelerator calls for a 1.4 MW beam of negatively charged hydrogen ions (H^-) to be generated and accelerated to an energy of one billion electron volts (1 GeV). This specific commissioning module allows the beam to reach energy of 7.8 MeV. Additional description of the project may be found at http://www.sns.gov/projectinfo/.

Organization

The SNS Accelerator Systems Division (ASD) is composed of approximately 120 physicists, engineers and technicians. ASD has established a Commissioning Team structure consisting of Managers for each major technical area. This structure will provide day-to-day and weekly coordination of commissioning activities.

ARR Team

Members of the ARR team and their primary responsibilities are in the ARR Plan of action. Please see Appendix 2.

L. Brown from the local Area Office of the DOE participated as a team member in the review. G. Dodson, Operations Manager for the ASD, was the primary point of contact for the ARR team.

Conclusions

It is the consensus of the ARR Team that the SNS Project has conducted a comprehensive review and all provisions of the SAD necessary for this phase have been incorporated into facility and SNS Project practice. All controls and policies are in place to transport beam safely from the source to the beam stop. ARR Evaluation Reports were prepared by each ARR team member and were attached in Appendix 4. The ARR Evaluation Reports identify a number of pre- and post-start findings that are summarized in the following section. Pre-start findings were closed on August 26, 2003.

Summary of Pre-start and Post-start Findings

Topic: ALARA and Radiological Control Program

Pre-start Findings

Obtain portable radiation detectors capable of integrating and accurately responding to mixed field dose rates produced from short pulse-width beams.

Change the DTL-1 gate postings to "High Radiation Area with Beam On."

Post-start Findings

Revise the ASD organization chart to delineate clearly the reporting responsibilities for the RSO, ES&H Coordinator and RCT Supervisor.

SNS has a plan for adding matrixed RCTs as construction and commissioning continue during the next several years. The FY'03 budget allows for about 0.25 FTE of RCT support, but they have no control over RCT availability. SNS should make arrangements for dedicated RCT support in FY'04 and beyond for periods of beam commissioning.

Develop a routine survey "tickler" system.

Charter a departmental ALARA Committee prior to target commissioning.

Develop a procedure for review of archived Chipmunk data.

Develop a procedure for trending of beam loss data and radiological survey data.

Author a procedure for passive area monitoring. The procedure should address monitoring in posted Controlled Areas where dosimetry is not required for access. The procedure should require documentation of TLD placement (i.e., maps), provide directions for the number of TLDs to be used, and provide directions on how to account for occupancy in calculating annual doses.

Review whether the title "Instrument Coordinator" has any value to the SNS radiological control program and, if not, remove it from all documentation.

Revise SNS OPM 3.A-3.1.3 to include a reasonable delay prior to entry to allow for decay of short-lived radioactivity.

All operating procedures should be verified and validated to ensure that they can be performed as written. The individual conducting the validation should have responsibilities for actually performing the procedure.

Topic: Closeout of Prior ARR Open Items

None

Topic: Closeout of Prior Internal SNS Evaluations

None

Topic: Commissioning ASE

Pre-start Finding

Ensure the correct value for the OE for the DTL Tank 1 and D-Plate is listed in SNS-OPM 2 B-1.

Post-start Findings

None

Topic: Cooling Water Systems (Activation Issues)

None

Topic: Electrical Safety Program

Pre-start Findings:

None

Post-start Findings:

Clarify the applicability, authorization and approval of carrying out hot work.

Continue to try to clarify the use of LOTO procedures to help ensure consistency of application across SNS and ORNL.

Institute an electrical distribution equipment preventive maintenance program.

Topic: Emergency Procedures

Pre-start Findings:

None

Post-start Findings:

A short flow chart describing emergency response procedures should be written for operators to better define their roles in an emergency. Example: what should the operating crew do if they discover a beam-on incident? How far should equipment be turned off (you want to be safe, but at the same time preserve information for a later investigation). Possibly need direction for fire, beam-on emergency, tornado, and at some point, ODH emergency.

Topic: Environmental Management and Waste Management

None

Topic: Fault Study Plan

Pre-start Findings:

Finalize the fault study procedure.

Develop a fault study plan as required by the procedure and indicate the beam parameters and locations of the beam losses to be studied in the plan.

Indicate the expectation dose rates in the fault study plan.

Design the fault study measurements so that they are aimed at determining:

- the attenuation achieved in labyrinth legs
- the maximum fault dose rates at ALL penetrations
- the optimum location for placing the interlocking chipmunk area radiation monitors
- routine dose rates outside thick shielding

The plan should include an attempt to determine the quality factor for neutrons for this location since the spectrum of neutron energies will be changing along the length of the Linac.

Have the fault study plan approved by line management.

Post-start Findings:

A fault study logbook or permanent retrievable record of the fault studies needs to be set up so that it can be maintained for 75 years.

Survey records created by the RSO or RCTs during the fault studies need to be signed and maintained with the permanent record.

The measured quality factor should be used to adjust the local chipmunk response so that it more correctly measures the dose equivalent rate in a mixed radiation field.

Area radiological controls should be updated, if required, based on the results of fault studies.

Topic: Fire Protection Program

None

Topic: Implementation of Commissioning Plan

Pre-start Findings:

None

Post-start Finding:

The SNS should choose a plan of action of how they plan to schedule commissioning of DTL2-6 and CCL. They should share their proposed plan of action with the ARR Review Committee and acquire our concurrence on the future plan of action for DTL2-6 and CCL.

Topic: Implementation of Conduct of Operations

Pre-start Findings:

None

Post-start Findings:

As more operational experience occurs, Conduct of Operations needs to be updated to reflect Lessons Learned.

Topic: Implementation of Administrative Limits

None

Topic: Machine Protection Systems

Pre-start Findings:

None

Post-start Findings:

The use of jumpers needs to be tracked and formally controlled.

The tables that are used to control machine-status-masking of inputs needs to be strictly controlled with a review, test and protection process.

All MPS equipment should be labeled with warning labels, including a contact phone number.

Topic: Maintenance Program and Procedures

Pre-start Findings:

None

Post-start Findings:

The routine electrical system maintenance needs to commence. Delayed maintenance on the electrical system will lead to future hazards such as equipment overloads and electrical fires, which in turn have an impact on safety and schedule.

A schedule for full system implementation of DataStream 7i needs to be established.

Topic: Occupational Safety and Health Program

Pre-start Findings:

None

Post-start Findings:

Continue to work with ORNL to integrate Safety Management Systems, including training.

Topic: Operations Procedures

Pre-start Findings:

If the Prox card access is to be the access method to DTL-1/3 enclosure for operational running, training must be completed and the access procedure must be updated before running.

Post-start Findings:

From an auditor's point of view, the index to the procedures on the web is somewhat confusing with regard to what is active and what is not active. While this may be clear to SNS personnel, it confuses the auditor. An index that reflects the current on-line procedures, as opposed to future procedures, needs development.

Topic: Personnel Protection System – Certification Procedures and Results

Pre-start Findings:

None

Post-start Findings:

The format of the procedures should be reviewed to see if segmentation and use of single step action steps would allow greater flexibility in scheduling and reduce interference with other pre-start activities.

ASD management should review procedure error-correction requirements and allow simple corrections to be made without stopping the procedure execution. The procedure changes can be reviewed and approved at the time the completed procedure is approved and the system certified.

Replacement of damaged equipment with an identical unit or pre-approved equivalent should be permitted with only a repeat of relevant steps in the procedure.

The PPS Team Head should review and approve the results of an executed procedure.

The list of approved testers should be formalized.

The PPS Team Head should retain copies of approved executed procedures.

Topic: Quality Assurance Plan

Pre-start Findings:

None

Post-start Findings:

Request assistance from ORNL with the development of a checklist that will capture hazards identified in Research Safety Summaries (RSS) documents.

Develop a Performance Assessment Plan that outlines mission and ESH&Q goals.

Describe the assessments and metrics that will be used to measure success.

Share Lessons Learned with partner labs and ORNL. The Lockout/Tagout and Klystron Lessons Learned are examples of Lessons that should be shared.

Identify at least one individual in the organization to be trained as a Critique Facilitator.

Topic: Radiation Shielding

Pre-start Findings:

Ensure that the present configuration of the shielding is maintained. (See Radiation Shielding and Configuration Control topic.)

Post-start Findings:

As specified by SNS-OPM 2.H-7.5, ensure that radiation surveys are performed during beam delivery.

Work on developing a "permanent" solution to the front end-DTL interface shielding concern so that it does not remain an ongoing operational concern.

Topic: Radiation Shielding and Configuration Control

Pre-start Findings:

Develop, approve and implement a procedure for ensuring that easily movable shielding, which is necessary for personnel protection, is properly located during beam delivery. This may include means for securing the shielding in place and posting it as being required for beam delivery.

Post-start Findings:

None

Topic: Sweep Procedures

Pre-start Findings:

Before running using the Prox card mode of entrance, more personnel must be trained in the Prox card system. It is especially important that all of the operators be trained.

The Sweep and Secure Procedure must be updated to discuss using the mirror during the sweep and secure process.

A label outside of the louver indicating "absolutely no access permitted past these louvers" is required at the minimum. A better solution is to mount a grate outside the louver to prevent unauthorized access.

Post-start Findings:

SNS must not change over to controlled access mode until a review is completed. Controlled access should require each entrant to carry a key or some token that prevents the enclosure from being enabled for beam.

Topic: Training Program and Training Records

Pre-start Findings:

None

Post-start Findings:

SBMS Research Safety Summary documents could provide Line Management with a useful project-specific training tool if the documents are completed with full details of hazards and associated controls.

GoTrain data shows percent completion of courses and therefore overdue numbers. Overdue percentages for some courses were somewhat moderate. SNS should review their training completion percentages against their goals for training completion status, and determine if more effort should be applied to achieving a higher completion status percentage.

Appendix 1
Readiness Declaration for Drift Tube Linac Tank 1 Commissioning

OAK RIDGE NATIONAL LABORATORY

MANAGED BY UT-BATTELLE FOR THE U.S. DEPARTMENT OF ENERGY

SNS

701 Scarboro Road
Oak Ridge, Tennessee 37830
PHONE: (865) 241-6945
FAX: (865) 241-6739
Cell Phone: (865) 919 1070
E-MAIL: holtkamp@sns.gov

Norbert Holtkamp
Accelerator Systems Division
Division Director

August 8, 2003

Edward Lessard
SNS Accelerator Readiness Review Committee Chair
Brookhaven National Laboratory
Mail Stop 911B
Upton, New York 11973-5000

Dear Dr. Lessard:

Readiness for Drift Tube Linac Tank 1 Commissioning

I formally declare that the Spallation Neutron Source (SNS) Accelerator Systems Division is ready to commission Drift Tube Linac 1. This commissioning will take place in accordance with the SNS Accelerator Readiness Review Plan of Action. The readiness to commission includes the readiness of all Technical and Administrative Controls as well as Hardware and Personnel as required by DOE O 420.2A.

Best regards,

Norbert Holtkamp

NRH:dcs

cc: George Dodson
Thom Mason
Lester Price/DOE-ORO
File – SNS/DCC - RC

Appendix 2
The ARR Plan of Action for the DTL1 Review

Drift Tube Linac Tank 1 (DTL1)

Accelerator Readiness Review – Plan of Action

Objective: The objective of this review is to evaluate the preparation at the Spallation Neutron Source for DTL1 commissioning and to assure that the facility is prepared to operate in a safe and environmentally acceptable manner. The Accelerator Readiness Review (ARR) process will verify that necessary programs have been developed, that appropriate personnel have been assigned and trained, that operations and relevant procedures have been approved, and that safety significant systems and controls are in place. The ARR shall be performed consistent with the requirements of DOE Order 420.2A. It should be noted that the ARR process is not designed to evaluate the adequacy of the SAD, but rather is intended to confirm satisfactory closure of commitments made in the SAD and associated documents.

Methodology: The ARR Team shall verify operational and ESH program commitments and requirements have been satisfactorily addressed through review of documents, interviews with responsible personnel and facility walk-down. The programmatic areas to be evaluated and responsibilities of each team member are defined in Table 2. Team members will provide a brief summary of their review for inclusion into the SNS ARR file.

It is noted that prior to the ARR, SNS internal reviews for DTL1 were performed at the SNS facilities. These evaluations are an important adjunct to the ARR process - closure of findings associated with these internal reviews will be verified during the ARR.

Criteria for Pre-Start and Post Start Findings: The ARR Team will identify findings reported by the team as either a Pre-start or Post-start finding. A Pre-start finding must be corrected before an activity can be started. A Post-start finding can be corrected after the start of the activity under review. The following are issues that are likely to rise to the level of an ARR finding:

- Non-compliance with ORNL-approved start-up directives
- Lack of adequate procedures or administrative systems having safety importance
- Operational or administrative non-compliance with procedures having safety importance
- Past corrective actions that been lacking or ineffective
- Operator training having safety importance not specified in existing training
- Previously unknown risk to worker, or unknown threat to the public or environment
- Inability for safe shutdown
- Loss of essential monitoring
- Operation outside the ASE
- Lack of control on the operability of equipment or subsystems having safety importance
- Violation or potential violation of worker OSH requirement
- Violation or potential violation of environmental protection requirement

- Non-safety processes, functions, or components that could adversely impact safety

Scope: The purpose of this review will be to verify that the engineered safeguards, administrative controls and procedures necessary for proton commissioning of DTL1 have been provided as committed in the current SAD. In particular, the ARR team will focus on:

Scope of review

1. Resolution of prior SNS internal reviews
2. Resolution of prior ARR open items
3. Status of interlock system installation and testing
4. Operational procedures for proton operation
5. Operator or system specialist training & qualification
6. Safety Assessment Document commitments for:
   - shielding
   - critical devices
   - access control
   - radiation monitoring
   - occupational safety and health
   - fire protection
   - quality assurance
7. The fault study plan
8. The ASE and commissioning plan for DTL1 commissioning

Schedule: The onsite ARR will be conducted August 12 through 14, 2003. A closeout meeting with SNS management and DOE representatives will be held on August 14 at a mutually agreed upon time. Preliminary work will be performed via phone interviews in the weeks prior to the site visit.

A report addressed to Frank Kornegay, SNS ESH Manager, with recommendations and conclusions will be prepared at the completion of the review and finalized by August 29.

ARR Team Members: Members of the ARR team are listed below in Table 1. A more detailed breakdown of the scope of each team member's work is provided in Table 2.

Table 1

Name	Affiliation	Phone Number	Email Address
Etkin, Asher	BNL	631-344-7200	etkin@bnl.gov
Kennedy, Sandra	ORNL	865-576-0240	kennedysb@ornl.gov
Lessard, Ed	BNL	631-344-4250	lessard@bnl.gov
Mau, Bob	FNAL	630-840-4429	mau@fnal.gov
Ruzicka, Bill	ANL	630-252-6834	wruzicka@anl.gov
Schaefer, Chuck	BNL	631-344-4728	schaefer@bnl.gov
Werbeck, Dick	LANL	505-667-5680	rwerbeck@lanl.gov

L. Brown from the local Area Office of the DOE will participate as a team member in the review and will provide DOE oversight of the process and findings. Mark Vance, ORNL Quality Office, will attend as an observer.

George Dodson, Operations Manager for the SNS Accelerator Systems Division, will be the primary point of contact for the ARR team.

Table 2 DTL1 ARR Assignments[1]

Topic	Lessard	Werbeck	Etkin	Kennedy	Schaefer	Ruzicka	Mau
ALARA Program					x		
Closeout of Prior ARR Open Items						x	
Closeout of Prior Internal SNS Evaluations				x			
Commissioning ASE	x						
Cooling Water Systems (Activation Issues)					x		
Electrical Safety Program		x					
Emergency Procedures							x
Environmental Protection Program	x						
Fault Study Plan	x						
Fire Protection Program	x						
Implementation of Commissioning Plan						x	
Implementation of Conduct of Operations							x
Implementation of Administrative Limits						x	
Interlock Testing Procedures and Test Results			x				
Machine Protection Systems			x				
Maintenance Program and Procedures	x						
Occupational Safety and Health Program		x					
Operations Procedures							x
Quality Assurance Plan				x			
Radiological Control Program					x		
Shielding and Configuration Control		x					
Sweep Procedures				o			x
Training Program and Training Records				o		x	
Field Interviews	x	x	x	x	x	x	x
Field Verification	x	x	x	x	x	x	x

[1] An "x" indicates the designated individual has primary responsibility for evaluation of the programmatic area. An "o" indicates at least two individuals will work on the topic. For all topics, team members are expected to assist the primary in order to complete the ARR in the time allotted.

Appendix 3
SNS Presentations at Opening Meeting on August 12, 2003

Accelerator Readiness Review
For
Drift Tube Linac Tank 1

Monday, August 11

20:30 Committee Only Dinner, Burchfield's at the Doubletree Hotel (formerly the Garden Plaza).

Tuesday, August 12

07:30	Breakfast	
08:00	Welcome and Project Overview	Norbert Holtkamp
08:20	ARR Plan of Action	Ed Lessard
08:40	SNS ES&H Overview	Frank Kornegay
09:00	Front End Closeout	George Dodson
09:20	Safety, Lessons Learned	Sam McKenzie
09:40	LOTO	Mario Giannella
10:00	Break	
10:15	Radiation Safety and Shielding	Don Gregory
10:45	PPS	Paul Wright
11:05	MPS	Coles Sibley
11:20	Front End Commissioning, Lessons Learned	Alexander Aleksandrov
12:05	Preparation for Commissioning	George Dodson
12:30	Lunch	
13:00	ARR Preparation, Procedures and Operations Training	Mario Giannella
13:25	DTL Tank 1 Commissioning, Physics Plan	Eugene Tanke
13:45	Beam Fault Studies	Stuart Henderson
14:00	Tour	
17:00	Committee Deliberations	
19:00	Dinner at the Bleu Hound Restaurant	

Wednesday, August 13

07:30	Breakfast	
08:00	Ion Source	Martin Stockli
08:15	Vacuum, Water and Magnets	Michael Hechler
08:30	RF Systems	Ray Fuja
08:45	Diagnostics	Tom Shea
09:00	Electrical Systems	Roy Cutler
09:15	Controls	Dave Gurd
09:30	Quality Assurance	John Mashburn
9:45	Break	
10:00	Breakout Sessions with Reviewers	
	Room 101-A	
	Room 101-B	
	Room 2102	
	Room 3127	
12:00	Lunch	
	Breakout Sessions with Reviewers	
14:00	Break	
	Breakout Sessions with Reviewers	
16:00	Meet for Committee to Questions	

Thursday, August 14

07:30	Breakfast
08:00	Respond to Committee Questions
09:00	Committee Report Preparation
12:00	Lunch
14:00	Closeout with Committee

Presentations can be found at
https://www.sns.gov/projectinfo/operations/ARR/ARR.htm

Appendix 4
ARR Team Member Evaluation Reports

ARR Evaluation Form

Topic: Implementation of Administrative Limits during Commissioning of DTL-1

Date: 8/13/03

I. Evaluation Criteria:
During Commissioning of DTL-1, has compliance to Administrative Limits been adequately installed into the Beam Commissioning Plan and the training of the commissioning team?

II. Records Reviewed:
Drift Tube Linac Tank 1 Beam Commissioning Plan-SNS 104020000-PR0001-R00;
Accelerator readiness Review Plan of Action-Revision 3;
SNS-OPM2.B1-Operational Envelope and Accelerator Safety Envelope for Front End and DTL-1 Commissioning;
SNS-OPM 2.H-7.5 Requirements for Radiological Resurvey for New Operating Parameters;
SNS ASE, SNS CASE, SNS OE.

III. Interview Conducted:
E. Tanke, M. Giannella, G. Dodson, T. Williams

IV. Sites Visited:
701 Scarboro
SNS Site

V. Discussion of Results:
   b. The commissioning of Drift Tube Linac Tank 1 is controlled by a comprehensive DTL-1 Beam Commissioning Plan. This document lists all commissioning tasks, goals, and output beam parameters.
   c. SNS-OPM 2.B-1 defines the Operational Envelope (OE) and the Accelerator Safety Envelope (ASE) fro DTL-1 Commissioning. The OE will never be less restrictive than the ASE.
   d. SNS is following the DOE Accelerator Safety Order 420.2A, which requires strict adherence to the bounding conditions of the ASE. Seeing that the OE parameters are more restrictive than the ASE, SNS should not exceed any ASE parameters during DTL-1 commissioning.
   e. The Operations Coordinator and on-duty Chief Operator are also instructed to follow the Operational Envelope parameters listed in OE-SNS-6.1 – 6.5. These procedures list limits for beam current, beam loss, personal protection system availability and envelopes, accelerator control room operation, and chipmunk monitoring system calibration and testing.
   f. SNS-OPM 2.B-1 lists specific Operational Envelope Limits. For example, the Maximum OE is given as 18kw and typical beam power and current

limits are specified. Please note the 18 kW OE must be reduced to 11.7 kW. Please see the Evaluation Form for the ASE.

g. SNS-OPM 2.B-1 lists the persons by titles that are responsible for the plant during DTL-1 commissioning and the minimum number and placement of qualified operators. That being, two qualified operators on shift during machine operations with particle beam and one of these in the control room at all times.
h. DTL-1 commissioning is to be pursuant to the commissioning plan and will be lead by a core commissioning team. This commissioning team is lead by E. Tanke and has seven members including G. Dodson and S. Henderson. This team will meet daily during commissioning and will develop a plan of the day or short term plans of action. The team will print the actions of the day on a white board. These details will then be placed into the control room electronic log book. These plans of the day will list the systems to be checked out for the upcoming day and will list specific parameter thresholds that cannot be passed until further permission is given. These thresholds always fall below or at the OE. Health Physics will have a separate white board with HP parameters which will not be exceeded until further permissions are given, dose rates in specific locations for example. These radiological thresholds will also be transposed into the control room's electronic logbook.

VI. Conclusion:

The SNS organization has an adequate system to implement administrative limits during commissioning.

VII. Recommendations:

None.

Reviewer: W. Ruzicka

ARR Evaluation Form

Topic: ALARA and Radiological Control Programs

Date: 08/14/03

I. Evaluation Criteria:

SNS Radiological Program Documentation and ORNL SBMS Requirements

II. Records Reviewed: (A sampling of available documents)

ORNL Radiological Work Permit 6010-11303 Rev. 2

SNS OPM 2.H-7.1, SNS Radiation Shielding Policy

SNS OPM 2.H-7.3, Inspection of Radiological Barrier Fencing (Draft)

SNS OPM 2.H-7.4, Review of SNS ASD Radiation Shielding

Safety Features Inspection Report for RGD Unit # XG-3171 (DTL3)

SNS OPM 3.A-3.1.1, Access Control Procedure for DTL1/D-Plate and DTL3 Enclosure

SNS ASD Organization Chart dated 5/01/03

SNS RSC Charter

SNS RCS Minutes dated 4/10/02, 4/17/02, 4/24/02, 5/01/02, 5/21/03, 6/05/02, 8/14/02, 5/21/03, and 6/05/03

TLD Readings During the Tank 3 and Tank 1 Conditioning, August 2003

Drift Tube Linac Tank 1 Beam Commissioning Plan

SNS Final SAD for the Front End, Linac and Klystron, August 2002

Prediction of the Radiation Fields for Commissioning of the SNS Linac, Popova and Gallmeier

Residual Doses for DTL Tank 1 Commissioning with the Beam Stop Wrapped in Borated Polyethylene, F. Gallmeier, February 2003

Evaluation of Shielding Configuration for DTL Tank 1 Commissioning, F. Gallmeier, August 2003

III. Interview Conducted:

S. McKenzie, D. Gregory, P. Gonzalez

IV. Sites Visited:

SNS Construction Site

V. Discussion of Results:

1. The Radiological Controls staff (RCT Supervisor and RCT(s)) is not well integrated within the SNS department. The ASD organization chart does not identify the RCT Supervisor (P. Gonzalez) even though he is matrixed to SNS full time from Radiological Support Services. It is not clear who he reports to. The organization chart also does not clearly delineate the reporting relationship between the ES&H Manager, RSO and ES&H Coordinator.
2. The instruments used by RCTs for routine radiation (dose rate) surveys of pulsed beams have not been proven to be capable of accurately measuring fields produced from short pulse width beams. Inconsistent readings obtained with the REM-500 (neutron dose rate survey meter) during Front End Commissioning were communicated to the Oak Ridge Calibration Laboratory, but have not been resolved.
3. Only several ORNL RCTs, none of which directly report to the SNS RCT Supervisor, are available to support commissioning that is expected to be a 24/7 operation for two months. The lack of dedicated RCT support may hinder operations efficiency.
4. The labyrinth gate to DTL1 is posted as a "Radiation Area with Red Light On, RWP Required for Entry". The TLD assessment conducted during DTL conditioning documented average whole body (i.e., 12-inch) dose rates in excess of 100 mrem/h. The gate should be posted as a "High Radiation Area" with beam on.
5. SBMS provides guidance on routine survey frequency for radiologically controlled areas. SNS currently has radiologically controlled areas but no routine survey program documentation for these areas exists.
6. SNS does not have an ALARA Committee. It is suggested that consideration be given to chartering a departmental ALARA Committee by the time target commissioning commences. The committee should be composed of departmental machine experts, operations staff, maintenance staff, and health physics support staff.
7. Archived area monitoring data provided by Chipmunks should be reviewed on a periodic basis. The ASD does not address this in any operating procedure.
8. Step 3.4 of the ASE for Front End and Linac Commissioning states that "loss monitoring results and radiation survey results shall be used to maintain beam loss ALARA as defined in an approved operations procedure". No implementation procedure exists on how to perform this requirement or on trending of survey results over time.

9. Step 2.2 of the ASE for Front End and Linac Commissioning states that doses at any location "routinely occupied by workers or members of the public without dosimetry" shall be kept less than 100 mrem/yr. SNS does not have a process for identifying these areas, or a procedure for how to conduct and interpret results from passive area monitoring with TLDs in these areas.
10. Section 4.2.2. of the SAD (Radiation Monitors) states that the "Instrument Coordinator" specifies the location of passive area monitoring TLDs. This responsibility is shared between the ES&H Manager and the RSO. The title of "Instrument Coordinator" should be eliminated to avoid confusion.
11. The access control procedure for DTL1/D-Plate and DTL3 enclosure does not provide for a standard cool down period (e.g., 30 minutes) to allow for radioactive decay of short-lived induced radioactivity.
12. Some procedures require further clarity. For example:
    a. SNS OPM 2H-8, Radiological Posting and Personnel Exclusion Triggers, states that the RSO and Chief Operators are responsible for "anticipating and measuring changes in the radiation environment". It is the RCT's responsibility to measure and document changes in the radiation environment in the workplace.
    b. SNS OPM 2.H-7.5, Requirements for Radiological Resurvey for New Operating Parameters, states that the Chief Operator will ensure RCT coverage is provided when specific beam parameters (i.e., beam power, duty factor, and total extracted current and extracted ion beam current) are "increased by more than a factor of two above settings that have had a radiological survey". There is no local beam power indicator available to the Operators so there is no mechanism for them to enforce this requirement. The distinction between total extracted current and extracted ion current is also not clear.

VI. Conclusion:

Provided the pre-start findings are corrected the SNS radiological control program is adequate to support beam commissioning of the DTL1 tank and enclosure. The department has adequate professional staff with expertise in radiation protection to fully implement the ORNL Radiation Protection Plan and address health physics issues as they arise. The SNS radiological program is immature but reflects the pre-operational phase the project is in.

SNS Out year budgets reflect a commitment to adding RCTs commensurate with machine construction and commissioning. SNS should plan, however, for dedicated RCT support during periods of beam commissioning to maximize operational efficiency.

VII. Recommendations

1. Revise the ASD organization chart to clearly delineate the reporting responsibilities for the RSO, ES&H Coordinator and RCT Supervisor (post-start).
2. Obtain portable radiation detectors capable of integrating and accurately responding to mixed field dose rates produced from short pulse width beams (pre-start).
3. SNS has a plan for adding matrixed RCTs as construction and commissioning continues during the next several years. Their FY' 03 budget allows for about 0.25 FTE of RCT support, but they have no control over RCT availability. SNS should make arrangements for dedicated RCT support in FY' 04 and beyond for periods of beam commissioning (post-start).
4. Change the DTL1 gate postings to "High Radiation Area With Beam On" (pre-start).
5. Develop a routine survey "tickler" system (post-start).
6. Charter a departmental ALARA Committee prior to target commissioning (post-start).
7. Develop a procedure for review of archived Chipmunk data (post-start).
8. Develop a procedure for trending of beam loss data and radiological survey data (post-start).
9. Author a procedure for passive area monitoring. The procedure should address monitoring in posted Controlled Areas where dosimetry is not required for access. The procedure should require documentation of TLD placement (i.e., maps), provide directions for the number of TLDs to be used, and provide directions on how to account for occupancy in calculating annual doses (post-start).
10. Review whether the title "Instrument Coordinator" has any value to the SNS radiological control program and, if not, remove it from all documentation (post-start).
11. Revise SNS OPM 3.A-3.1.3 to include a reasonable delay prior to entry to allow for decay of short-lived radioactivity (post-start).
12. All operating procedures should be verified and validated to ensure they can be performed as written. The individual conducting the validation should have responsibilities for actually performing the procedure (post-start).

Reviewer: C. Schaefer

ARR Evaluation Form

Topic: Closeout of Prior ARR Open Items

Date: August 12, 2003

I. Evaluation Criteria:

To evaluate if the prior ARR Committee Open Items have been closed out.

II. Records Reviewed:

Action Item Report-Front End Accelerator Readiness Review-October 2002.
OPM Procedures Review Status Spreadsheet-Mario Giannella.
SNS-OPM 2.H-7.5.
SNS-OPM 2H-8.
2N2-OPM 2.B-1.

III. Interview Conducted:

M. Giannella,G Dodson, N. Holtkamp

IV. Sites Visited

701 Scarboro

V. Descussion of Results:

The Accelerator Readiness Review for the Front End was held October 14-17, 2002. 46 Action items were generated by the Committee review. Closeout of 29 was needed for Front End Commissioning. These 29 issues were closed out via a Committee and SNS video conference On October 28 and confirmed closed by the ORNL (non- SNS) member of the Committee. The Committee thereafter recommended that the DOE grant permission to begin Front End Commissioning. The remaining 17 items, not closed in October 2002, were tracked with the SNS Action Tracking System.

The ARR Committee reconvened at SNS on August 12, 2003. The SNS Management announced that all remaining 17 items had been closed. They presented to the Committee an Action Item Report-Front End Accelerator Readiness Review October 2002 spreadsheet. The spreadsheet listed each ARR item via action item number, title, description, and close out response.

I interviewed M. Giannella, G. Dodson, and N. Holtkamp, and reviewed the Action Item Report and the above listed documents.

VI. Conclusion:

All Action Items have been closed out.

VII. Recommendations: None

Reviewer: W. Ruzicka

ARR Evaluation Form

Topic: Commissioning Accelerator Safety Envelope

Date: 08/14/03

I. Evaluation Criteria:

The procedure that addresses the ASE-required equipment and systems must specify the minimum necessary system components and monitoring devices to allow operation. If these minimums are not met, actions are specified.

II. Records Reviewed:

SNS-OPM 2.B-1, Operational Envelope and Accelerator Safety Envelope For Front End and DTL-1 Commissioning, Revision 2, June 9, 2003.

SNS 6.E-2, Operational Approval for Front End System and DTL1 Commissioning, Revision 00, June 4, 2003.

III. Interview Conducted:

George Dodson

IV. Sites Visited:

701 Scarboro
SNS Site

V. Discussion of Results:

A review of SNS-OPM 2 B-1 indicates the Operational Envelopes (OE) are boundaries of operation that are not to be exceeded during normal operations. During the presentations by SNS staff, the OE for the DTL Tank 1 and D-Plate was beam power, and it was indicated to be 11.7 kW. SNS-OPM 2 B-1 indicates the OE for beam power is 18 kW. Other aspects of SNS-OPM 2 B-1 were updated to account for the DTL1 commissioning.

VI. Conclusion:

It is the consensus of these ARR Team members that all relevant provisions of the ASE necessary for DTL1 commissioning are being addressed. Adequate controls and policies are in place to transport beam safely from the ion source to the beam stop.

VII. Recommendation

Ensure the correct value for the OE for the DTL Tank 1 and D-Plate is listed in SNS-OPM 2 B-1.

Reviewer: Ed Lessard

ARR Evaluation Form

Topic: Emergency Response

Date: 8/14/03

I. Evaluation Criteria: evaluating emergency response procedures

II. Records Reviewed:

III. Interview Conducted: Mario Giannella, Ted Williams

IV. Sites Visited: 701 Scarboro, main SNS site

V. Discussion of Results: Discussed who responds to a fire alarm. Discussed what procedures exist for a beam-on emergency. Discussed operations role in emergency; clearly ODH emergency role is needed.

VI. Conclusion: In general it looks like ORNL provides emergency response and the operators are not really part of SNS emergency response. Example: no local beam on emergency procedure.

VII. Recommendation: a short (possibly flow chart) describing emergency response procedures be written for the operators to better spell out their roles in an emergency. Example what should the operating crew do if they discover a beam-on incident. How far should equipment be turned off (you want to be safe but at the same time preserve information for a later investigation).

Probably need one procedure on fire, beam-on emergency, tornado, and at some point ODH emergency.

Reviewer: Bob Mau

ARR Evaluation Form

Topic: Environmental Management and Waste Management

Date: 08/14/03

I. Evaluation Criteria:

SBMS Subject Area for Environmental Management and Subject Area for Waste Management

II. Records Reviewed (A sampling of available documents):

Permit to Construct or Modify an Air Containment Source Issued Pursuant to Tennessee Air Quality Act

Construction Site Stormwater Control and Pollution Prevention Plan for the Spallation Neutron Source, 108020300-PN0001-R03, October 2, 2002

Spallation Neutron Source Preliminary Waste Management Plan, SNS 102030000-TR0002-R01, June 2002

Migration of Activation Products from the Oak Ridge Spallation Neutron Source Facility Shield Berm on Chestnut Ridge on the Oak Ridge Reservation, ORNL/TM-1999/290, SNS-108030200TR0001R00

Application for a National Pollution Discharge Elimination System (NPDES) Permit for Discharges of Wastewaters to the Headwaters of White Oak Creek from the Spallation Neutron Source (SNS) Facility, DOE Letter, George Malosh to Paul Davis, November 27, 2002.

Executive Management Team Meeting Agenda for the weeks 7/1/2003 through 8/05/2003.

JFI/JFC Weekly Safety Report, week ending 7/11/2003

Weekly Safety Walk, 8/11/2003, Knight/Jacobs Joint Venture

Subcontractor Coordination Meeting Minutes, 8/7/2003

DOE email, SNS Site Observations Weeks Ending 7/04/03 and 7/11/2003, Cathy Stachowiak

III. Interview Conducted:

Frank Kornegay

IV. Sites Visited:

701 Scarboro

V. Discussion of Results:

Environmental issues are communicated to management and staff on a regular basis. The SNS project has internal operations procedures for notifications of environmental events. The sub-contractor, DOE Site Office personnel and SNS management are actively engaged in ESH walk downs of the construction site and in reviewing ESH events. They observe work and communicate observations and recommendations to the work force and upper management.

VI. Conclusion:

Although only a part of the environmental record was sampled, it appears that all environmental documentation and permits are ready for commissioning. Feedback and improvement is a core value of Integrated Safety Management and it is practiced by SNS management in the areas of environmental protection and safety.

VII. Recommendations

None.

Reviewer: E. Lessard

ARR Evaluation Form

Topic: Fault Study Plan

Date: 08/15/03

I. Evaluation Criteria:

The fault study plan should provide sufficient information to SNS Management, the Radiation Safety Committee (RSC), machine physicists, the RSO, RCTs and Control Room operations staff. The information should be related to the hazards associated with conducting fault studies. The plan should have sufficient information to allow management of SNS to make a wise decision about whether or not the study is appropriate, and the fault study approval-process should demonstrate that line management is in control of the study and the potential hazards.

II. Records Reviewed:

2.H-16. Fault Study Procedure for Primary and Secondary Beam Areas, Draft, May 21, 2003.

III. Interview Conducted:

Mario Giannella, Stuart Henderson, Don Gregory

IV. Sites Visited:

701 Scarboro

V. Discussion of Results:

The procedure examined was in draft form. The procedure indicates a fault study plan must be written and that expectation dose rates need to be stated for the various faults to be studied. The procedure indicates the fault study plan must be approved by the Radiation Safety Officer.

VI. Conclusion:

The fault study plan was not completed since the procedure was in draft form. The physicist in charge of the study had plans as to where to fault the beam but he had not generated expectation dose rates.

The fault study plan should be approved by line management as opposed to the approval by the RSO. The RSO should concur with the study from the standpoint that the RSO has the available RCTs for the study and appropriate instrumentation

is available. The RSO should concur that he is prepared to control access to normally occupied areas where abnormal radiation fields will be intentionally created.

Management needs to demonstrate they are in control of the machine and the immediate environment at all times, especially during studies that involve intentional beam losses at unusual locations. Management needs to indicate they accept the risk associated with creating hazardous or unexpected dose rates. Management also needs to demonstrate they are in control of the nearby environment, which may require temporary road closures and temporary work stoppages during the study.

VII. Recommendations

Pre-start:

Finalize the fault study procedure.

Develop a fault study plan as required by the procedure and indicate the beam parameters and locations of the beam losses to be studied in the plan.

Indicate the expectation dose rates in the fault study plan.

Design the fault study measurements so that they are aimed at determining:

- the attenuation achieved in labyrinth legs
- the maximum fault dose rates at ALL penetrations
- the optimum location for placing the interlocking chipmunk area radiation monitors
- routine dose rates outside thick shielding

The plan should include an attempt to determine the quality factor for neutrons for this location since the spectrum of neutron energies will be changing along the length of the Linac.

Have the fault study plan approved by line management.

Post Start:

A fault study logbook or permanent retrievable record of the fault studies needs to be set up so that it can be maintained for 75 years.

Survey records created by the RSO or RCTs during the fault studies need to be signed and maintained with the permanent record.

The measured quality factor should be used to adjust the local chipmunk response so that it more correctly measured the dose equivalent rate in a mixed radiation field.

Area radiological controls should be updated, if required, based on the results of fault studies.

Reviewer: E. Lessard

ARR Evaluation Form

Topic: Fire Protection Program

Date: 08/15/03

I. Evaluation Criteria:

SNS FSAD for FELK, Table 5.1.1 – 1, item 3.8 - Compensatory action shall be taken if neither fire detection nor fire protection is available to an accelerator building that is greater than 4000 square feet.

SNS FSAD for FELK, Table 5.1.1 – 1, item 4.2 - Fire detection/protection systems shall be tested periodically in accordance with applicable NFPA standards.

II. Records Reviewed:

FPE Review of Temporary Hydrocarbon Shielding in Linac Tunnel, e-mail correspondence from J. Eckroth to S. McKensie dated January 17, 2003.

Inspection, Testing and Maintenance of Wet Pipe Sprinklers in FELK, Wet-Pipe System Annual IT&M Report – Bldg. 8100 & 8300.

Inspection, Testing and Maintenance of Fire Alarm Devices in FELK, Fire Alarm System Annual Test Report – Bldg. 8100, 8200 & 8300

Fire Extinguisher Inspection Reports, Latest Month, Bldg. 8100, 8200 & 8300

ORNL Fire Department Pre-Fire Plan, Representative Sample – Bldg. 8100

Log of NS Fire Alarms, October 20002 to Present

III. Interview Conducted:

None. Contact for documentation was J. Eckroth.

IV. Sites Visited:

701 Scarboro

V. Discussion of Results:

The use of temporary combustible shielding for DTL1 commissioning was reviewed. Annual and quarterly testing reports show a few minor problems such as battery corrosion. Otherwise, the reports show no major repairs or part replacements. The

log of SNS Automatic Fire Alarms show some repeat alarms due to cutting and welding in areas with active smoke detection.

VI. Conclusion:

The testing and inspection documentation demonstrates the fire protection program is robust and testing is performed on schedule.

VII. Recommendations

None.

Reviewer: E. Lessard

ARR Evaluation Form

Topic: Maintenance Management Program

Date: 08/15/03

I. Evaluation Criteria:

Maintenance involving the safety aspects of DTL1 commissioning has been identified. Maintenance procedures for safety systems have been developed, reviewed, verified and approved. Procedures for safety-related maintenance are kept current.

II. Records Reviewed:

DataStream 7i on-line maintenance management system.
Fire protection system maintenance documents.

III. Interview Conducted:

George Dodson

IV. Sites Visited:

701 Scarboro
SNS Site

V. Discussion of Results:

Maintenance plans and procedures are not in the OPM; rather they are in a computerized maintenance management system, DataStream's 7i. The computerized system links maintenance plans to procedures and other documents such as training records. Routine maintenance notifications are sent automatically be email. The system produces work permits, ESH requirements and, at some future time, it will check training status for individuals assigned to perform maintenance.

All equipment at SNS has been bar coded provided it meets established criteria. There are 2800 pieces of equipment in the DataStream database. An individual has been assigned to populate the database with all remaining equipment. Routine maintenance is not being managed by the system at this time. Electrical equipment is beginning to age and routine maintenance is not being performed at this time.

VI. Conclusion:

The system is state of the art. SNS has led the way and it has wide acceptance at ORNL. However, full maintenance-management-system implementation is key to

future SNS operations years from now since SNS will require high availability of equipment for future physics programs. A robust routine maintenance program for accelerator equipment will help ensure availability.

Maintenance of the fire-safety system is robust and on-going, and is not part of the DataStream management system at this time. Routine testing of the PSS system is robust and is not part of the DataStream 7 I system at this time.

VII. Recommendations

The routine electrical system maintenance needs to commence. Delayed maintenance on the electrical system will lead to future hazards such as equipment overloads and electrical fires, which in turn have an impact on safety and schedule.

A schedule for full system implementation of DataStream 7i needs to be established.

Reviewer: E. Lessard

ARR Evaluation Form

Topic: Operations Procedures

Date: 8/14/03

I. Evaluation Criteria: appraising Operations Procedures, and training related to operations procedures.

II. Records Reviewed: Looked at training records of Operations department, checked out operations procedures on sweep (found several), access (found several), log book keeping, ion source operational guidelines and Authorization 3.A-4.1.3 AND 3.A-4.1 AND3.A-3.1.3 AND3.A-3.1.1

III. Interview Conducted: Mario Giannelle, Ted Williams.

IV. Sites Visited: 701 Scarboro, and main SNS site.

V. Discussion of Results: Went Through listing of operations procedures to determine if enough procedures had been developed to allow running beam to DTL1. In addition checked training records for operators on these procedures.

VI. Conclusion: Procedures for commissioning DTL1 seem to be in order. It is always difficult to write procedures before one operates an area. At the very least safety procedures, sweep, access procedures need to be developed, and they are. In addition I found procedures written that reflect previous running of the Front end had been developed, and operators had been trained on this, which indicates that they are proactive in developing procedures as operational knowledge is available.

I found following the index of procedures a little cumbersome in that procedures had been written that reflect the long-range future. An example is an on-line overall procedure on access. In addition I found a 2nd access procedure (temporary procedure) that reflected that current actual access procedure to the DTL1/3 enclosure. Both are on the active index one reflects reality one is preparation for the future. Is this a good concept? SNS has also modified access to the DTL1/3 enclosure that uses the prox card for access. This is a recent change, and not enough people are trained.

VII. Recommendation: If the prox card access is to be the access method to DTL1/3 enclosure for operational running, training must be completed, and the access procedure must be updated before running.

From an Auditors point of view, the index to procedures on the web is somewhat confusing. What is active and not active? While this may be clear to SNS

personnel, it confuses an auditor. An index that reflects the current on-line procedure as opposed to future procedures needs development.

Reviewer: Bob Mau

ARR Evaluation Form

Topic: Occupational Safety and Health

Date: 8/14/03

I. Evaluation Criteria:

SNS FSAD for FELK, SNS-102030103-ES0008-R00, Item 4.1.2, Job Hazard Analysis, 8/02

II. Records Reviewed:

SNS FSAD for FELK, SNS-102030103-ES0008-R00, Item 4.1.2, Job Hazard Analysis, 8/02

SNS-OPM 2., Safety

Numerous ASD Job Hazard Analyses

ASD Go Train Training Matrix, 8/13/03

III. Interview Conducted:

Sam McKenzie, 8/12-13/03

Frank Kornegay, 8/13/03

IV. Sites Visited:

n/a

V. Discussion of Results:

Job Hazard Analysis is considered THE tool for planning and conducting work at SNS. It is an evolving system that is credited with partially contributing to the outstanding safety record that SNS has thus far exhibited. A review of a sampling of JHAs indicates a wide range of quality and worker participation in their development. The facts that there are JHA Go Train training, active management support and technical help available for their preparation are real pluses.

Standards Based Management System is used as the safety management system (SMS) for ORNL; it is an evolving system that is in constant development. Where possible, SNS uses SBMS, but it has not been and is not now always appropriate for use at SNS. This is partly for historical reasons and partly because SBMS was not developed enough when it was needed in the past. With SNS developing its own SMS while ORNL was developing SBMS, this led to a two track approach to safety which could be confusing and result in inconsistencies. According to the SNS ES&H Officer, the goal is to

eventually use SBMS as much as possible at SNS; where SBMS is not appropriate or adequate, SNS-specific systems or procedures will be used. Only when SNS-specific systems are not adequate will ASD-specific procedures be developed. This will hopefully and eventually help to avoid inconsistencies and duplication. This is already evolving as can be seen when examining several of the items of Section 2. in the OPM where there are direct links to SBMS. In addition, SNS people are now actively participating in ORNL-wide SBMS safety area development teams – another positive step.

Safety training is another area where ORNL and SNS have different systems, including tracking. Again, these differing paths developed historically out of necessity but could lead to confusion. ORNL uses the SAP system while SNS uses the Go Train training system. Again, the SNS ES&H Officer acknowledges this situation and is actively working with the ORNL Training Coordinator to integrate these efforts.

VI. Conclusion:

The SNS Safety Management Systems are working even though there is the potential for confusion and inconsistencies between ORNL and SNS. This could develop into a problem.

VII. Recommendation:

Continue to work with ORNL to integrate Safety Management systems, including training. (post-start)

Reviewer: R. Werbeck

ARR Evaluation Form

Topic: Evaluating Sweep and Enclosure Access

Date: 8/14/03

I. Evaluation Criteria: Evaluating Sweep of DT1/DT3 enclosure and accessing DT1/DT3 enclosure.

II. Records Reviewed: 3.A-4.1.3 AND 3.A-4.1 AND3.A-3.1.3 AND3.A-3.1.1

III. Interview Conducted:
Mario Giannella, Ted Williams, Paul Wright, Bill Stone

IV. Sites Visited:
Linac Control room, current tunnel that houses DTL1/DTL3

V. Discussion of Results:

1. Upon entering we found that not all people had been trained to use prox cards and that the tunnel access electronics had recently been modified to have the prox card unlock the door to permit access.
2. We spent time discussing the mirror used to see on top of some ventilation equipment. We discovered that Operators were trained to search and secure the hall and were trained to use the mirror. How ever the S&S procedure does not mention using the mirror in the S&S sequence.
3. After you go through the 2nd door lentil going towards the DTL1 enclosure there is a set of louvers that open to the outside. The louvers could allow an access to the hall if some one demolished the louvers or was doing louver maintenance.
4. The search and secure sequence (sweep) seemed to be well thought out.
5. The current secure sequence and access to the hall is fundamentally sound; however, a comment on controlled access is warranted for future running. Currently, no key or token is taken into the enclosure to prevent running beam; this is ok because the interlocks are dropped for all accesses, thus a sweep is required before beam is enabled. If in the future controlled access is permitted, where interlocks are not dropped and a sweep is eliminated, then a key or interlocked token must be carried by each entrant in order to prevent running of beam. Alternatively, a gate watch may be posted whose only job is to ensure each entrant has left prior to enabling beam.

II. Conclusion:

1. Before running using the prox card mode of entrance more personnel must trained in the prox card system. This is clearly important and all the operators especially must be trained.

2. The S&S procedure must be updated to discuss using the mirror during search and secure.
3. A label outside of the louver saying absolutely no access permitted past these louvers is required at the minimum. A better solution is to mount a grate outside the louver to prevent unauthorized access.
4. Nothing further in item 4.
5. Modification of DTL 1 enclosure to handle the controlled access mode should not be done unless some system is developed whereby each entrant must carry an interlocked key or equilvent.

III. Recommendation:

Before running DTL1 number 1, 2 and 3 must be done. Also no changing over to controlled access until a review is completed which would include every one making an access being required to carry a key or some token.

Reviewer: Bob Mau

ARR Evaluation Form

Topic: **Training**

Date: **August 13, 2003**

I. Evaluation Criteria:

- Training appropriate for operations
- Training of personnel achieved as required by safety documentation
- SNS training program consistent with ORNL SBMS expectations

II. Records Reviewed:

- List of required training for accelerator operators
- Spreadsheet of training status
- Training records of accelerator operators in SAP
- SNS site access training
- SNS Orientation Handbook
- ASD DTL Enclosure Access Training (TA001) viewgraphs and test

III. Interviews Conducted:

S. McKenzie, SNS ASD ES&H
T. Williams, SNS ASD Operations Coordinator
M. Giannella, SNS ASD Operations Physicist
F. Kornegay, SNS ESH Manager

IV. Sites Visited:

701 Scarboro
SNS site

V. Discussion of Results:

- Comprehensive training program addresses both operations and ESH. Training to specific procedures as required by SAD.
- Good Lockout/Tagout Practical Factors developed. Equipment-specific LO/TO procedures including hands-on training could add value.
- Lessons Learned from operations incorporated in LO/TO training. LO/TO verification awareness conducted after shortcomings discovered.
- SNS-specific Radiological Worker I Practical Factors conducted by SNS RCT provides site-specific information.
- Four operators have completed DTL Enclosure Access Training.

- SAP requires an ORNL badge number to record training records; therefore, GoTrain is used for most of the training.
- GoTrain provides web-based training with audio, interactive exercises, knowledge feedback, and an opportunity to ask questions on-line. This requires passing score for successful completion. GoTrain maintains training records per SBMS requirements.
- Operations Coordinator maintains a spreadsheet of training, trainers, training objectives, training materials, training frequency, and qualifications imparted.

VI. Conclusion:

Training program is appropriate for operation of DTL-1. Training of personnel has been achieved as required by safety documentation. The SNS training program is consistent with ORNL SBMS expectations.

VII. Recommendation:

SBMS Research Safety Summary documents could provide Line Management with a useful project-specific training tool if the documents are completed with full details of hazards and associated controls. Go Train data shows percent completion of courses and therefore also overdue numbers. Overdue percentages for some courses were somewhat moderate. SNS should review their training completion percentages against their goals for training completion status, and determine if more effort should be applied to achieving a higher course completion status percentage.

Reviewers: S. Kennedy, W. Ruzicka

ARR Evaluation Form

Topic: Radiation Shielding

Date: 8/13/03

I. Evaluation Criteria:

SNS FSAD for FELK, SNS-102030103-ES0008-R00, 8/02:
Table 4.1.1.1-1, SNS Shielding Policy, and Item 4.2.1.1.1, Bulk Shielding Criteria

SNS-OPM 2.H-7.1., SNS Radiation Shielding Policy, 8/29/02

SNS-OPM 2.H-5., SNS Radiation Safety Policy, 8/29/02

II. Records Reviewed:

SNS-OPM 2.B-1., Operational Envelope and Accelerator Safety Envelope for Front End and DTL-1 Commissioning, 6/9/03

SNS-OPM 2.H-7.4., Review of SNS ASD Radiation Shielding, 6/13/03

SNS-OPM 2.H-7.5., Requirements for Radiological Resurvey for New Operating Parameters, 10/26/02

SNS-OPM 2.H-7.6., SNS Radiation Shielding Configuration Policy, 8/30/02

SNS-OPM 2.H-7.7., SNS ASD Procedure for Removal or Modification of Radiation Shielding, Barriers or Primary Area Beam Line Components, 6/13/03

SNS-106100200-TR0084-R00, Evaluation of Shielding Configuration for DTL Tank 1 Commissioning, 8/03

SNS Drawings 104000000-M8D-8200-A20,A21,A22,A23-R01, DTL-1 Shielding Configuration, signed 8/11/03

III. Interview Conducted:

Franz Gallmeier and Irina Popova, 8/13/03

George Dodson, 8/12/03

Don Gregory, 8/13/03

IV. Sites Visited:

SNS Front End Building and Linac Tunnel

V. Discussion of Results:

The SNS Radiation Shielding Policy mandates compliance with 10CFR835.1002(b). In addition, the FSAD for the FELK and SNS-OPM 2.H-5 specify a bulk shielding dose rate design criterion of less than 0.25 mrem/hr for continuously occupied areas. A review of the DTL Tank 1 commissioning shielding evaluation and a discussion with Franz and Irina indicate that the shielding enclosure as installed will be adequate for DTL Tank 1 commissioning, as planned. Beam Power of 16 kilowatts was considered in the evaluation. The Operations Envelope beam power limit is 18 kilowatts while the DTL Tank 1 commissioning beam stop is suitable for nearly 12 kilowatts of beam power.

Extensive 3D Monte Carlo calculations using MCNPX identified two potential "weak" spots in the shielding. One is upstream of the front-end–DTL interface just outside the shield enclosure (nearly two-thirds neutrons), and the other is outdoors just north of the permanent entrance maze (nearly all gammas). The former will most likely remain an area of concern even after commissioning while the latter will not be a problem during normal beam delivery (after DTL Tank 1 commissioning). Section 5.1 of SNS-OPM 2.H-7.5 specifies radiation survey requirements during beam delivery periods.

VI. Conclusion:

The DTL shielding enclosure as installed will provide adequate protection to personnel from exposure to radiation produced during beam delivery for commissioning DTL Tank 1.

VII. Recommendation:

As specified by SNS-OPM 2.H-7.5., ensure that radiation surveys are performed during beam delivery. (post-start)

Ensure that the present configuration of the shielding is maintained. (See Radiation Shielding Configuration Control topic.)

Work on developing a "permanent" solution to the front end-DTL interface shielding concern so that it does not remain an ongoing operational concern. (post-start)

Reviewer: R. Werbeck

ARR Evaluation Form

Topic: Machine Protection System

Date: August 14, 2003

I. Evaluation Criteria:
Configuration control

II. Records Reviewed:
None

III. Interview Conducted:
C. Sibley

IV. Sites Visited:
SNS Site

V. Discussion of Results:
The system uses both special purpose modules and PLC's. The fast shutoff utilizes dedicated modules. There are multiple sources of input that may or may not be masked depending upon exact beam parameters. Individual inputs can be masked independent of machine status. In order to accomplish, this requires a hardware jumper and a software switch. The jumpers are placed in equipment in unsecured cabinets

.

VI. Conclusion:
As the machine installation continues, the number of inputs will grow rapidly and the tracking of their status will become very cumbersome. Presently there is no formal configuration control of these controls.

VII. Recommendation
The use of jumpers needs to be tracked and formally controlled. The tables that control machine status masking of inputs need to be strictly controlled with a review, test and protection process. All MPS equipment should be labeled with warning labels, including a contact number.

Reviewer: A. Etkin

ARR Evaluation Form

Topic: Personnel Protection System - Certification Procedures and Results

Date: August 13, 2003

I. Evaluation Criteria: Is certification procedure adequately documented, approved and reviewed after execution.

II. Records Reviewed:
SNS-OPM 3.A-7.4 Personnel Protection System Testing and Certification Procedures
SNS-OPM 3.A-7.4.5 Personnel Protection System Phase 0.4 (Front End, DTL 1 and 3 Only) Testing and Certification Procedure

III. Interview Conducted:
P. Wright
W. Stone

IV. Sites Visited:
SNS Site

V. Discussion of Results:
There is a fully approved certification procedure for the presently operational system. The PPS Team is responsible for the final certification of the PPS. This procedure is an unsegmented full system test, consisting of verbose multi-action steps. There is a final signoff by the personnel performing the procedure indicating satisfactory completion. The completed procedure is reviewed and approved by SNS ASD Operations Manager. Personnel performing this procedure are required to be current in all safety related training and to be certified in the operation of the PPS. Completed procedures are to be kept in the CCR. Any procedure errors require stopping the procedure and formally changing the procedure before resuming the procedure. Any equipment repairs require a repeat of the procedure.

VI. Conclusion:
There is an executed and approved PPS certification procedure. The format of the procedure made it difficult for me to evaluate the procedure. The all inclusive structure and the multi-action steps are a concern for the expanded system. The list of approved tester is not formally controlled. The error correction and equipment repair requirements may in the future be a significant impediment.

VII. Recommendation
The format of the procedures should be reviewed to see if segmentation and use single action step will allow greater flexibility in scheduling and reduce interference with other pre-start activities. ASD management should review the

error correction requirements and allow simple corrections to be made without stopping the procedure execution. The changes can be reviewed and approved at the time the completed procedure is approved and the system certified. Replacement of damaged equipment with an identical unit or pre approved equivalent should be permitted with only a repeat of relevant steps. The PPS Team Head should also review and approve the completed procedure. The list of approved tester should be formalized. PPS Team Head should retain copies of approved completed procedures.

Reviewer: A. Etkin

ARR Evaluation Form

Topic: Radiation Shielding Configuration Control

Date: 8/14/03

I. Evaluation Criteria:

SNS FSAD for FELK, SNS-102030103-ES0008-R00, Item 4.2.1.2, Moveable Shielding, 8/02

II. Records Reviewed:

SNS-OPM 2.H-7.4., Review of SNS ASD Radiation Shielding, 6/13/03

SNS-OPM 2.H-7.5, Requirements for Radiological Resurvey for New Operating Parameters, 10/26/02

SNS-OPM 2.H-7.6., SNS Radiation Shielding Configuration Policy, 8/30/02

SNS-OPM 2.H-7.7., SNS ASD Procedure for Removal or Modification of Radiation Shielding, Barriers or Primary Area Beam Line Components, 6/13/03

SNS Drawings 104000000-M8D-8200-A20, A21, A22, A23-R01, DTL-1 Shielding Configuration, signed 8/11/03

III. Interview Conducted:

George Dodson, 8/12-14/03

Mario Giannella, 8/12/03

Don Gregory, 8/13/03

IV. Sites Visited:

SNS Front End Building and Linac Tunnel

V. Discussion of Results:

The FSAD for the FELK assumes that any shielding blocking a significant hazard is too heavy to be moved by an unaided individual. This is not necessarily true for polyethylene slabs that are commonly used for shielding from low-energy neutrons. Borated polyethylene slabs are used in the DTL shielding enclosure as it is presently configured for DTL Tank 1 commissioning. Their use will continue even during normal beam delivery.

SNS-OPM 2.H-7.6 states the policy for shielding configuration planning, approval and control, but there is no procedure for ensuring that easily movable shielding that is necessary for safe beam delivery is properly located.

The drawings noted above were signed off by the SNS RSO, the ASD Operations Manager, ASD survey personnel and an ASD mechanical engineer indicating and verifying that the shielding constituting the DTL Tank 1 commissioning enclosure and the required shielding inside the enclosure are properly configured. This is a good practice. The question is: how do you ensure that this configuration (especially for easily movable shielding) is maintained?

VI. Conclusion:

Although easily movable shielding is required and used in the DTL shielding enclosure, there is no procedure for ensuring it is in place during beam delivery.

VII. Recommendation:

Develop, approve and implement a procedure for ensuring that easily movable shielding which is necessary for personnel protection is properly located during beam delivery. This may include means for securing the shielding in place and posting it as being required for beam delivery. (pre-start)

Reviewer: R. Werbeck

ARR Evaluation Form

Topic: Electrical Safety Program

Date: 8/14/03

I. Evaluation Criteria:

SNS FSAD for FELK, SNS-102030103-ES0008-R00, 8/02:
Item 3.2.5.2.1.2, Site Electrical Distribution System, and Item 4.2.5, Lockout/Tagout

SNS-OPM 2.F., Lockout/Tagout

SNS-OPM 2.G., Electrical Safety

II. Records Reviewed:

SNS-OPM 2.G-2., Electrical Safety Implementation Plan, 10/21/02

SNS-OPM 2.G-3., SNS Electrical Safety Working Hot Guidelines, 10/21/02

Grounding Plan records including one-line drawings and test reports for Klystron Substation I

Long Term Order, Electrical Safety and Working on or near Exposed Voltages, 10/23/02

III. Interview Conducted:

Mario Giannella, 8/13/03

Sam McKenzie, 8/13/03

Frank Kornegay, 8/13/03

Paul Holik, 8/13/03

IV. Sites Visited:

SNS Front End Building and Linac Tunnel

V. Discussion of Results:

The site grounding plan is robust with a 100' x 100' copper wire mat buried beneath the buildings. Tie-ins to the building steel were inspected. Cable trays throughout the facility are also adequately grounded.

Electrical distribution equipment is relatively new throughout the facility, but it will require an ongoing preventive maintenance program very soon so that it does not start to deteriorate and cause reliability problems.

Regarding LOTO, progress made since the 10/02 ARR has been impressive. The 11/02 LOTO stand down and inspection and the LOTO hands-on training program were very important steps in helping to fully implement the program. The LOTO verification awareness training that briefed people on the zero-energy check step in LOTO was very impressive. Finally, the 1/03 LOTO audit helped to verify the effective evolution of the program. All of this was done with full ORNL SBMS subject area participation – a very positive step. This interaction has led to recent SBMS subject area changes in LOTO. There is still some concern that there are differences between the ASD LOTO procedure and that of ORNL and even other divisions within SNS.

Finally, regarding working hot, even though there is an approved working hot procedure, no hot work is presently being undertaken. There is some confusion regarding authorization to do so. It is generally believed that with appropriate training and management review and approval, hot work should be permitted. However, the SNS ES&H Officer realizes there is some confusion and plans to clarify the situation for SNS in the near future. ASD accelerator operators are specifically prohibited from performing hot work through the Long Term Order noted above.

VI. Conclusion:

Substantial progress has been made in the electrical safety program (including LOTO) at SNS since the last ARR. There is still room for clarification in the areas of working hot and consistency in LOTO procedures that are or may be used.

VII. Recommendation:

Clarify the applicability, authorization and approval of carrying out hot work. (post-start)

Continue to try to clarify the use of LOTO procedures to help ensure consistency of application across SNS and ORNL. (post-start)

Institute an electrical distribution equipment preventive maintenance program. (post-start)

Reviewers: R. Werbeck and E. Lessard

ARR Evaluation Form

Topic: Cooling Water Systems (Activation Issues)

Date: 08/14/03

I. Evaluation Criteria:

Operating procedures and activation analyses

II. Records Reviewed:

SNS OPM on D-Plate Cooling and RCCS

Water Activation In The Linac Structures, October 2002

III. Interview Conducted:

G. Dodson

IV. Sites Visited:

SNS Construction Site

V. Discussion of Results:

The DTL RCCS takes advantage of system design (e.g., limited beam penetration into Faraday Cups) to eliminate the potential for direct impingement of the proton beam onto cooling water. The potential for production of tritium, radioactive beryllium and radioactive carbon is therefore minimized. The RCCS is a closed system, and heat exchange with the chilled water system occurs in the Klystron Gallery.

The documented water activation analysis adequately addresses buildup of expected radioactive contaminants (e.g., H-3, Be-7, C-11) as a function of machine operation.

VI. Conclusion:

Appropriate cooling water system configuration controls are in place to support DTL1 enclosure commissioning.

VII. Recommendation

None

Reviewer: C. Schaefer

ARR Evaluation Form

Topic: Implementation of Commissioning Plan - DTL1 and Near Term Future

Date: 8/14/03

I. Evaluation Criteria:

Is the DTL1 Commissioning Plan adequate to commence DTL1 commissioning?
Is the current SNS plan for commissioning the DTL2-6 and CCL reasonable?

II. Records Reviewed:

Drift Tube Linac Tank 1 Beam Commissioning Plan-SNS 104020000-PR0001 - R00

Accelerator readiness Review Plan of Action- Revision 3

Memo dated 7/3 1/2003 written by G. Dodson, D-O. Jeon, S. Henderson, E. Tanke and titled 'Conclusions of Commissioning Schedule Review'

SNS-OPM2.B 1 -Operational Envelope and Accelerator Safety Envelope for Front End and DTL1 commissioning

III. Interview Conducted:

G. Dodson, M. Giannella, E. Tanke, N. Holtkamp

IV. Sites Visited:

701 Scarboro

V. Discussion of Results:

1) Much of the detail and review results of this subject are presented in the ARR Evaluation Form titled "Implementation of Administrative Limits during Commissioning of DTL1."
2) The commissioning of Drift Tube Linac Tank 1 is controlled be a comprehensive DTLl Beam Commissioning Plan. This document lists all commissioning tasks, goals, and output beam parameters.
3) SNS is following the DOE Accelerator Safety Order 420.2A, which requires strict adherence to the bounding conditions of the ASE. By following their written commissioning plan the SNS should not exceed any ASE parameters during DTL1 commissioning.
4) Operator training is in place to support DTL- 1 commissioning.
5) The machine protection system (MPS) is in place, and will be a redundant backup during commissioning. That is, commissioning limits are in place, but the MPS

system is also in place to protect the machine and protect against excessive machine produced radiation.

6) The SNS team presented the ARR team with a preliminary plan for near term future commissioning of DTL2-6 and the CCL. The plan listed four scenarios for future DTL and CCL commissioning. The SNS team currently seems to favor Scenario 1. Scenario 1 discusses Commissioning of DTL Tanks 2-3 together and then Tanks 3-6 with the CCL. This plan could allow for schedule advantages.

VI. Conclusion:

Documents inspected and interviews conducted, lead me to conclude that if SNS follows minimal punch list pre-commissioning action item resolutions, then DTL-1 will be ready to commence commissioning, and that the DTL1 commission plan is adequate to proceed.

SNS should soon pick a scenario for commissioning of DTL2-6 and CCL. They should share their chosen scenario with the ARR Team. We expect that via a telephone or videoconference discussion, the ARR could concur with the chosen commissioning scenario to proceed with the remaining DTs and CCL.

VII. Recommendation:

No recommendations on DTL1 commissioning plan.

The SNS should choose a plan of action of how they plan to schedule commissioning of DTL2-6 and CCL. They should share their proposed plan of action with the ARR Review Committee and acquire our concurrence on the future plan of action for DTL2-6 and CCL.

Reviewer: W. Ruzicka

ARR Evaluation Form

Topic: Quality Assurance

Date: August 13, 2003

I. Evaluation Criteria:

- Confirmation of closeout of prior internal SNS evaluations
- SNS operations consistent with safety documentation
- SNS operations consistent with ORNL SBMS expectations, particular focus on work control, performance assessment, procurements

II. Records Reviewed:

- SNS Preliminary Final Safety Assessment, January 2002
- SNS Commissioning Program Plan, July 2002
- SNS Accelerator Readiness Review Front End and Klystron Gallery Commissioning, October 25, 2002
- Accelerator Readiness Review Plan of Action, Rev. 2, May 2003
- Closeout Report on the DOE Review Committee for the Technical, Cost, Schedule, and Management Review of the SNS Project, May 8, 2003
- Drift Tube Linac Tank 1 Beam Commissioning Plan, August 6, 2003
- SNS Quality Assurance Plan, SNS-QA-P01, Rev. 3, April 2003
- SNS assessments (13) in ORNL Assessment Tracking System
- Emails from McKenzie documenting safety walk-thru, observations
- Jankovic list of OSHA findings, May 12, 2003
- Action Items Report - Lessons Learned and Action Items from Front End Commissioning, 8/11/03
- SNS Research Safety Summary documents (12) in ORNL Research Hazard Analysis Control System, particularly RSS 1500.0 Electrical Systems
- SNS Procedure Job Hazard Analysis, 2/15/01
- 6 JHAs, particularly the JHA for testing DC magnet power supplies in the front end

III. Interviews Conducted:

- J. Mashburn, SNS Quality Assurance
- M. Gildner, SNS Quality Assurance
- F. Kornegay, SNS ESH Manager
- Presentation by R. Cutler, SNS ASD Electrical Systems Group Leader

IV. Sites Visited:

701 Scarboro
SNS Site

V. Discussion of Results:

- All actions from prior internal evaluations have been closed. Documentation includes descriptions of actions, taken. Requirements in safety assessment documentation are appropriately addressed.
- The Job Hazard Analysis for testing DC magnet power supplies in the front end does not identify all the hazards that were described during the presentation. The Research Safety Summary document does identify many of these hazards. The ESH Manager stated that JHAs are intended to be used on a day-to-day basis, while RSSs are considered to be higher level documents, capturing the full breadth of potential hazards that may be encountered during the course of the work. JHAs do not ask leading questions like RSSs; therefore, it is easy to overlook potential hazards. If a checklist of the hazards identified on a completed RSS could be provided, this could be used with JHAs to ensure that all potential hazards are considered on a day-to-day basis. The checklist could also be used by management as an assessment tool.
- Integrating quality requirements on a project with 5 partner labs presents a considerable challenge. SNS staff is confident that the program is working well. Quality is integral to all operations. The graded approach is applied, with focus on the "critical few." The manager responsible for SNS work components or systems is required to determine their acceptance criteria, with approval from QA. Inspection discrepancy reports are used to document problems with acceptance criteria. Management at all levels is responsible for evaluation through assessments. Performance assessment is integral to all operations, not just ESH. Monthly safety walk-throughs are conducted by the Division Director and ESH staff.
- The ORNL Assessment Tracking System is not accessible without an ORNL user ID and password, so SNS uses a different tracking system for action items. The ORNL Assessment Tracking System is used for tracking occurrences, non-conformance reports and some assessments.
- The SNS has responsibility for target and instruments procurements, partner labs have responsibility for procurements of other systems and equipment. QA representatives are part of each SNS group. SNS has 12 procurement specialists on staff.
- The ESH Manager has primary responsibility for monitoring SBMS and implementing needed changes. SNS staff actively participate in the development and review of SBMS procedures.

VI. Conclusion:

Quality encompasses everything that contributes to the success of an organization. The SNS has incorporated the principles of Integrated Safety Management Systems, Standards Based Management Systems and Performance Based Management Systems in all aspects of operations, using the graded approach, tailored to SNS-specific needs. Some gaps in documentation and performance exist, but these are easily remedied with a little more attention to detail.

Performance assessments are contributing to continuous improvement in operations. Continued participation in the development and review of SBMS procedures and sharing Lessons Learned from implementation will ensure that the SNS is perceived as an organization committed to the highest quality science, dedicated to excellence in all aspects of operations.

VII. Recommendations:

- Request assistance from ORNL with the development of a checklist the will capture hazards identified in RSS documents.
- Develop a Performance Assessment Plan that outlines mission and ESH&Q goals. Describe the assessments and metrics that will be used to measure success.
- Share Lessons Learned with partner labs and ORNL. Lockout Tagout Lessons Learned should be shared. The klystron event should be shared.
- Identify at least one individual in the organization to be trained as a Critique Facilitator.

Reviewer: S. B. Kennedy